



## **Attitude of visual impaired people to mathematics**

Iveta Kohanová <sup>1</sup>

### *Abstract*

This article describes pre-experiment that was done as component of doctoral thesis on the subject of mathematics and visual impaired people. Results of this experiment are helping us to continue in further research which is in progress.

Nowadays, we notice use of mathematics in lot of disciplines, not only in those that are very nearly related to mathematics, but also in unusual like biology, medicine, psychology or linguistics. We are witnesses to rapid expansion of information technologies that requires new technicians all the time. Hence, we can not marvel about attendance of blind people who would like to engage in study of mathematics. Thus it is needed to create acceptable conditions for studying and deal with problems, which blind people encounter.

These facts have inspired us to pay more attention to study of mathematics of visual impaired people. At first, we specified following aims:

- to find out the attitude of blind people towards mathematics by interview with them
- to acquaint oneself with problems they have/had in conjunct with mathematics at education
- to detect their ability to solve mathematical problems, even at the moment they strictly don't have to/didn't have to deal with mathematics at all
- to compare approaches and procedure of solving problems of blind and sighted people to investigate which part of mathematics is most difficult for blinds and why

In order to find answers to mentioned questions, we studied history of reading codes for the blind; Braille notation of some countries and its limitations in field of mathematics. As next we dealt with personality of visual impaired child and its development. After loss of the sight the system of reception and recognition of reality is rebuild. The process of formation of sensual experience of visually impaired persons is retarded. By help of teacher and special pedagogical

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<sup>1</sup> PhD student at Comenius University in Bratislava, Slovakia, Faculty of Mathematics, Physics and Informatics



instruments child adopts system of knowledge and step by step develops ability to use aural, kinetic, cutaneous and others analysers. So the sensual base is build that makes possible to develop more complicated psychic processes - perception, imagination, memory, thought and speech. We also have mapped the actual situation in Slovakia concerning teaching of mathematics of visual impaired students on each level (primary, secondary, university).

The most important part of our up-to-now research is experiment that has been realized in Bratislava and Palermo. We have prepared questionnaire which consists of 4 problems: one problem of algebra, one problem of analytic geometry, one business problem and one problem of Euclidean geometry. Its text was as follows:

#### Open problems

Solve the following problems. We don't mind the way of solution, but we take great interest in all used procedures. You are required to explain the strategy and all adopted reasoning you have used.

1. A father is 42 years old and his son is 16. In how many years will the father's age be triple than son's age? How would you interpret the obtained result?
2. Which are the symmetric points of the points  $P[3,2]$ ,  $Q[-2,3]$  as regard to the origin  $O[0,0]$ ? Which are the symmetric points of these points  $P$ ,  $Q$  as regard to the bisector belonging to the 1<sup>st</sup> and 3<sup>rd</sup> quadrant?
3. In period of the end of the season bag costs € 2.50 less. Then its price is lowered in 30 % again, so the bag costs € 28. What was the initial price?
4. Two triangles are given by having two proportional sides and the angle placed between them equal. How are these triangles related? A side belonging to the smaller triangle is 2 cm long, the corresponding side in the bigger triangle is 6 cm. The other side in smaller triangle is 3,2 cm long, the corresponding one is 9,6 cm long. How are the sizes of these triangles related?

As follows we made analysis apriori of possible and expected solutions of given problems. All that is part of phase of action of didactic situation; phase of formulation and phase of validation ensue. The theoretical framework is theory of didactic situations of Guy Brousseau [1].

Mentioned questionnaire was submitted in form of recorded interview to 4 blind Italians and 5 blind Slovaks. As it stands in questionnaire, we have focused on the strategy and approach used



by solving the problems. As well as on particular mathematical languages of interviewed persons. In order to have true image about interviewed persons, first they introduced themselves. We were interested in their "level" (knowledge) of mathematics and its particular parts, type of education and story of their blindness.

65 sighted students of Secondary Grammar School - Grösslingova, Bratislava, were asked to solve the same 4 problems. It deals with students of common classes 4.C and 4.D (18-19 years old), who had time of 20 minutes to solve given problems. We needed this sample of sighted respondents in order to be able compare if there are differences between blinds and sighted in approaches by solving of these mathematical problems. It is necessary to say that time of 20 minutes was satisfactory for students to reckoning. The blind respondents were not limited by time.

In analysis a posteriori we made qualitative and quantitative analysis of obtained answers. We present the conclusion of our experiment:

By our experiment we found that blind people are able to solve mathematical problems, although their approach and way of solution is a bit different than approach of the sighted persons. As regard to the algebra and arithmetic we discovered that mostly they prefer arithmetic. They don't use variable very often compares to the sighted students who do so many times. Nevertheless, we see analogies among the other used strategies.

As a next we researched the field of geometry. Most of sighted students drew a picture by solving given problems of analytical and Euclidean geometry. On the other hand, blinds have to use imagination, all object (solids and plane figures) are first touched and then stored. Geometry is for them kind of adaptation to the environment. We think this adaptation is dynamic in sense that they continually change the system of operation of environment that explores. Since every environment is a new environment he/she has to store all information (tactile, auditory, olphactive, etc.) and so make mental images. It is interesting for us to research more in field of geometry in connection with blind people, to see how they are adapted to various environments, what are their personnel tools. We would like to study more in the next research of the thesis how the blind people perceive the changing of the area and volume. Our expectation we define in following hypotheses:

**H1:** The blind people and sighted people have different point of view on geometry.

**H2:** The point of view on geometry of blind people is point of perception and it is dynamic.



**H3:** The point of view on geometry of sighted people is static.

We will verify these hypotheses experimentally. At the moment we are in the phase of preparation of new problems to solve.

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